• When n is large?

distribution of $X \sim$ normal

• large enough? $B(n, p)$

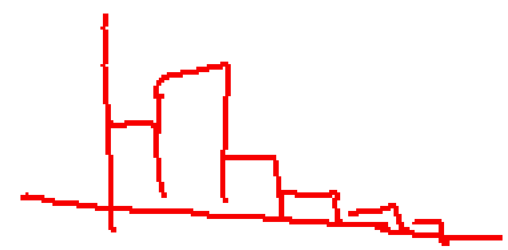
<u>check:</u> $n \cdot p$

$n(1-p) \geq 10$

Ex:

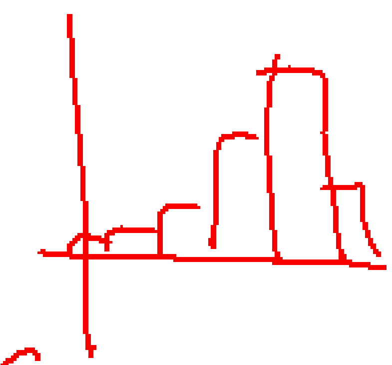
$n=5$

$p=0.20$



$n=5$

$p=0.85$



$n=5$

$p=0.5$

• Check passes then $X \sim$ normal

• Calculator: normalcdf(LB, UB, μ, σ)

• Formula sheet:

$\mu_x = n \cdot p \quad \sigma_x = \sqrt{n \cdot p(1-p)}$

Ex: $B(125, 0.75)$

Check

$P(X > 80) =$

normalcdf$\left(80, \text{E}99, (125 \cdot 0.75), \sqrt{(125 \cdot 0.75 \cdot 0.25)}\right)$

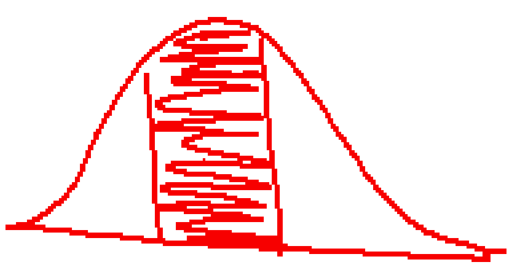
$(125)(0.75)$

$(125)(0.25) \geq 10$ ✓

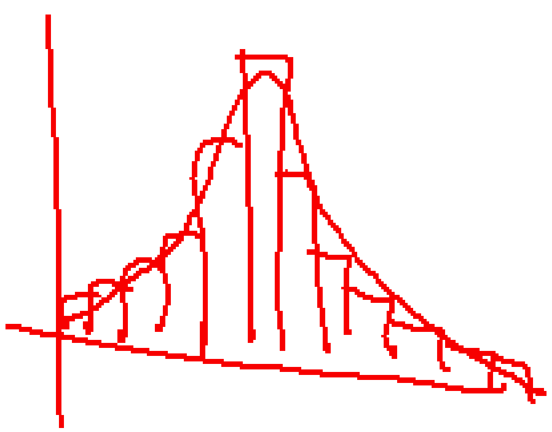
$= 0.9977$

Binomial r.v. = discrete

approx. with normal distr., wich is continuous



why?



• because normal vars. are easier to work w/.

• because the probabilities are essentially same

$P(X > 80) = 1 - P(X \le 80) = 1 - \text{binomcdf}(125, 0.75, 80) = 0.996$

Sample Proportions

$P(X > 80)$ $\qquad P(\hat{p} > 0.40)$

$P(75 < X < 85)$ $\qquad P(0.25 \le \hat{p} \le 0.38)$ $\qquad \cancel{\ }$ 51

discrete $\rightarrow B(n, p)$

p = pop. proportion

$\hat{p}$ = sample proportion $= \dfrac{X}{n}$ ← successes, ← sample size

$\hat{p}$ = are continuous $\qquad 0 \le \hat{p} \le 1$

$$\hat{p} \sim N\left(\overset{\mu_{\hat{p}}}{p}, \underbrace{\sqrt{\frac{p(1-p)}{n}}}_{\sigma_{\hat{p}}}\right)$$

Check: $\left.\begin{matrix} n \cdot p \\ n(1-p) \end{matrix}\right\} \geq 10$

$B(n, p)$

check passes... $\hat{p} \sim$ normal

Use: normalcdf(LB, UB, $\mu_{\hat{p}}$, $\sigma_{\hat{p}}$)

Ex: $B(1000, 0.15)$

$P(\hat{p} > 0.14)$

$= \text{normcdf}\left(0.14, E99, 0.15, \sqrt{\frac{(0.15 \cdot 0.85)}{1000}}\right)$

≈ 0.8119

Check

$(1000)(0.15)$

$(1000)(0.85)$ ≥ 10

Binomial R.V.

$B(n,p)$

check: $n \cdot p$
$n(1-p) \geq 10$

FAILS

Use: binomcdf
binompdf

• counts (#)
X

$P(X \geq \_\_\_)$

• $\mu_X = n \cdot p$

$\sigma_X = \sqrt{n \cdot p \cdot (1-p)}$

PASSES

use normalcdf

counts (#)
X

• $\mu_X = n \cdot p$

$\sigma_X = \sqrt{n \cdot p \cdot (1-p)}$

proportions (%)
$\hat{p}$

• $\mu_{\hat{p}} = p$

$\sigma_{\hat{p}} = \sqrt{\dfrac{p(1-p)}{n}}$

2-5, 8, 11

(3) a) 100 b) 34 c) 50

(2) a) Yes (b) NO (c) NO

(4) <u>Check:</u>

$(700)(0.05)$
$(700)(0.95)$ ≥ 10 ✓

$P(x \geq 50) =$

$\text{normalcdf}(50, \text{E}99, 35, \sqrt{700 \cdot 0.05 \cdot 0.95})$

$= 0.00464$

(5) <u>check:</u>

$(400)(0.48)$
$(400)(0.52)$ ≥ 10 ✓

$P(0.45 \leq \hat{p} \leq 0.55)$

$= 0.8826$

$\text{normcdf}\left(0.45, 0.55, 0.48, \sqrt{\frac{(0.48)(0.52)}{400}}\right)$